me back gradually to the Freiburg method of giving large doses.

The success of Roentgen rays treatment in gynecology depends, in my opinion, mainly on two factors: 1, proper selection and careful supervision of the cases; 2, the technic of application. The possibility of an error of diagnosis must always be before our mind; it is absolutely necessary to follow up every case carefully, in order to avoid the unpleasant occurrence that a malignant complication should be overlooked; only a competent gynecologist is able to do that; co-operation with an X-ray operator, Roentgenologist, appears to me not desirable; X-ray treatment for diseases peculiar to women should be carried out by a physician well trained in diagnosing these affections. The technic must and can be learned.

It is most important to avoid burns. It appears to me that many people have been burned, and a deep-rooted distrust and dislike is encountered in very many persons against the curative use of X-rays. The introduction of the aluminum filter has overcome all dangers for the skin; other precautions have certainly to be employed, and above all the dose has to be measured; re-application to the same part of the skin has to be carefully considered, etc.

Before closing, I wish to add to the foregoing personal experiences a few remarks that are based merely on study of literature and previous clinical observations. I have, as stated, treated so far only patients with fibromyoma uteri and metropathia hemorrhagica. I believe that X-rays can also be successfully applied in hemorrhages of the menarche, that is, floodings at the start of menstrual life; very favorable reports have been made.

Furthermore, I consider it of the very greatest importance that every woman who has had an operation for a malignant growth should be submitted to a regular treatment with X-rays after operation; this rule may well be extended to all and every case of operation for a malignant growth, in man as well as in woman where feasible. No doubt X-rays are able to destroy cancer cells; the knife altogether too frequently fails to remove all the neoplastic cells, which form the basis for a relapse. Early, extensive operation is not sufficient; a systematic X-ray treatment after operation is essential to increase the number of permanent cures.

BOTULISM: ITS OCCURRENCE IN CALIFORNIA.*

By ERNEST C. DICKSON, M. D., San Francisco.
(From the Division of Medicine of the Stanford University Medical School.)

The occurrence of several cases of botulism within the past few years would seem to justify a brief description of the disease, as it has received but little mention in the American literature. The importance of the condition insofar as the Pacific Coast states are concerned has been emphasized by the fact that there have been recently several fatal cases in California and one in Oregon. In November, 1913, twelve persons were stricken in an outbreak at Stanford University, one resulting fatally, and in reporting these cases Wilbur and Ophüls referred to two other outbreaks, one described by Sheppard in 1907 in which three persons died after eating canned pork and beans, and one described by Peck in 1910 in which twelve persons were affected and eleven died after eating canned pears. In both of these outbreaks the diagnosis of "ptomaine poisoning" was made, but in both the symptoms were identical with those of botulism, and it is highly probable that the bacillus botulinus was responsible for the poisoning. Since that time there has been an outbreak in Fallbrook, Cal., in which five persons died after eating canned apricots, and one in Boston with recovery in which the source of the poison was thought to be minced chicken.

The more recent cases have occurred within the past few months. In Hillsboro, Oregon, a woman and forty chickens died after eating canned corn, and in San Jose, Cal., a woman and eight chickens died after eating canned string beans. In both of these instances the patients died after an illness which in every way resembled botulism.

The most important fact concerning these cases is that, with two exceptions, all were produced by eating spoiled canned vegetables or fruits, and that in all of the latter the vegetables or fruits had been canned at home. Among the several hundred cases which have been described in the European countries the only outbreak in which the poisoning was traced to vegetables was that which occurred in Darmstadt in 1904 in which twenty-one persons became ill and eleven died after eating a bean salad which had been prepared in a cooking-school; and in this instance it was thought that there must have been some pork cooked with the beans because "it is not possible to cultivate botulinus in other than meat containing media" (Landman).

Subsequent to the outbreak at Stanford University, an investigation was undertaken in our laboratory to determine whether meat protein was necessary for the growth of the bac. botulinus and for the development of its toxin, and we found that in canned beans and canned peas in which the reaction had not been altered the toxin would develop in sufficient amount to produce the typical symptoms and to cause the death of animals which were inoculated. Leuchs reports that after the Darmstadt outbreak Gaffky had performed similar experiments, and that he had found that the toxin would develop in media prepared from beans, but that fact was not emphasized and has not been generally understood. The prevailing conception of the disease is that botulism is produced only by spoiled meats, usually pork, and that it is not produced by food that is of vegetable origin or in which the reaction is acid.

Botulism has been recognized in Europe for many years and there have been many cases reported in the European literature. It is a type of food poisoning which is characterized by peculiar disturbances of the central nervous system, and which in 1907 was found by van Ermengen to be due to the action of a toxin which is produced by the growth of an anerobic, spore-bearing bacillus

* For Bibliography see Botulism, an Experimental Study. Journ. Amer. Med. Assoc., 1915, LXV, 492.

to which he gave the name bacillus botulinus. The toxin may be separated from the bacilli by filtration of the medium through a Berkfeldt filter, and van Ermengen and others have shown that it is the toxin and not the bacilli which is responsible for the poisoning. The toxin develops only under anerobic conditions and is soon destroyed if exposed to light or to air, or if heated to 80 degrees Cent. (176 Fahr.). Its presence in media or in food is indicated by a peculiar rancid odor which resembles that of butyric acid and which is not unlike that of rancid butter or certain kinds of cheese.

The bacillus is a strict anerobe which is Gramm positive and which readily forms spores. It has been found in nature but once, and then in the feces of hogs (Kempner and Pollak). It grows most readily at a temperature of between 18 and 30 degrees Cent. although it may form its toxin at temperatures outside of these limits. The toxin is much more virulent if the bacillus is grown in an alkaline medium and in the dark. The spores are slightly less resistant to heat than are those of many other bacilli, but they will withstand heating to .. degrees Cent. for .. minutes.

But little investigation of the histology of botulism has been made on the tissues of human victims of the disease. Following van Ermengen's investigations, he, Marienesco, Kempner and Pollak, Römer and Stein and other authors made histologic examination of the tissues of animals in which the condition had been induced, and they all agreed that the most important lesion was a peculiar disintegration of the Nissl granules of the ganglion cells of the motor portions of the cord and of the medulla, pons and peduncles. Van Ermengen also described diffuse hyperemia and hemorrhages in the abdominal and thoracic organs as well as in the meninges.

In the Stanford University fatal case Ophüls found a peculiar cellular thrombosis of the vessels of the meninges and of the brain, many of which were filled with thrombus in which were many leukocytes. There was also marked hyperemia of the abdominal viscera, and small thrombi were found in the vessels of the intestinal sub-mucosa and in those of the cortex of the ovaries. Similar thrombi, hyperemia and hemorrhages were found in the brain and in the abdominal and thoracic viscera of the animals which were inoculated in our series of experimental botulism as well as in the tissues of the chickens and in those of the woman who died in the recent outbreak in San Jose.

The symptomatology of botulism has been summarized by van Ermengen as a neuro-paralytic symptom-complex characterized by disturbances of secretion and symmetrical motor paralyses. The first symptoms usually appear in from twelve to twenty-four hours after the ingestion of the infected food, but rarely they appear much earlier, in from one to two hours, and more often they are delayed, sometimes for as much as from three to nine days. There may be initial vomiting and diarrhea but usually the disease is characterized by the absence of acute gastro-intestinal disturbances, and obstinate constipation is more common than is diarrhea. Disturbances of vision are often the first thing noticed by the patient. There may be an initial dimness of vision without apparent retinal changes, and usually this is soon followed by disturbance of accommodation and double vision. Ptosis, mydriasis, nystagmus and strabismus may occur, and there is frequently much vertigo. Disturbances of speech and of swallowing soon follow. The latter is partly due to the fact that there is a diminution of the flow of saliva which becomes thick and viscid, but is chiefly due to paralysis of the muscles of deglutition. There is progressive muscular weakness which may increase until there is complete paralysis of the skeletal muscles. Headache and disturbances of sensation and of mentality are rare. There is usually a diminution of urinary output, due partly to lessened secretion and partly to retention. The temperature, pulse and respiration remain practically normal. In the fatal cases the progress of the disease is usually rapid and death occurs in from two or three to ten or twelve days. Death usually results from respiratory or cardiac failure.

The mortality varies in different outbreaks, but averages about forty per cent. of the infected cases. If the progress of the intoxication ceases before any of the vital functions are disturbed the prognosis is fairly good, although recovery is very slow and convalescence is tedious. The disturbances of vision appear to be the last to clear up, and cases are recorded in which there were still some ocular disturbances several years after the infection. The complication most to be feared is insufflation pneumonia but decubitus ulcers are not uncommon.

Diagnosis may be difficult if a single case is seen because of the close resemblance to acute bulbar paralysis, acute poliomyelitis, cerebral syphilis or gelsemium and hyoscyamus poisoning; but where a number of persons who have partaken of a common article of food develop the symptoms there is little difficulty in recognizing the cause.

In the more severe cases treatment is of little benefit, but since recovery occurs in so large a percentage of cases, active therapeutic measures should always be undertaken as soon as possible. The stomach and the colon should be thoroughly washed out to remove any toxin that may remain, active purgation should be induced if possible, preferably with castor oil or epsom salts, and the patient should be supported as much as possible. Strychnin seems to be of especial benefit in improving the action of the paralyzed muscles, and other stimulants should be given as indicated. The patient should be kept absolutely quiet and plenty of water and simple food should be supplied. The danger of insufflation pneumonia should be kept in mind and it is therefore better to give the water by rectum or by hypodermoclysis instead of by mouth.

Specific serums have been prepared and the results of their use in laboratory experiments have been most satisfactory, but it is necessary that they be given as early as possible. There is apparently some difference in the specific action of the various strains of the bacillus so that polyvalent sera are

preferable. At the present time I know of no supply in this country but there is little doubt that they will be available as soon as the need is recognized.

The importance of recognizing that botulism occurs in this portion of the country and that the toxin may develop in vegetables and probably also is fruits, can scarcely be over-estimated. In a locality in which so many fruits and vegetables are canned at home each year, the possibility of contamination with the bac. botulinus as well as the terrible results which may follow if the contaminated food is eaten, should be known to all the people. There is no doubt that the methods of sterilization which are commonly employed by the housewife in canning are inadequate. The United States Agricultural Department has issued bulletins in which it is urged that fractional sterilization be employed in canning fruits and vegetables, but this advice is disregarded by the great majority of housewives and cooks. The frequency with which jars of fruit and vegetables "spoil" is positive evidence that all the bacteria and molds have not been destroyed in the canning process. All that is necessary to place many lives in imminent danger is that the food happen to become contaminated with the spores of the bac. botulinus and that the sterilization be insufficient. And it should be remembered that the bacillus has been found in pig's feces, and that vegetables which are grown on ground which has been fertilized with hog manure may be contaminated with the spores. The sealing of the cans and storing of them in a dark place establish ideal conditions for the formation of the toxin, especially in a climate where the temperature is rarely below that at which the bacillus thrives.

It is urgent that a campaign of education be commenced as soon as possible and that persons who practice home-canning of fruits and vegetables be instructed in the proper methods of sterilization. It is to the medical profession that we must look for the inauguration of such a campaign, and the object of presenting this report is to place the matter before the physicians of the State.

DIAGNOSIS OF MALARIA.*

By J. R. SNYDER, M. D., Sacramento.

In January of this year we reported before the Sacramento Society for Medical Improvement our experiences with the urobilin test in malaria.[1] Since that time we have been able to make a considerable addition to our total number of cases studied and it is our intention today to call your attention to the findings and also to the conclusions we have reached after our second series.

Plehn, working in German East Africa, reported in 1909 his original work made in the attempt to find some means of recognizing that a return to the original locality is frequently followed by a return of symptoms of malaria. No doubt had the original infection been entirely cured there would not be a return of symptoms, but how is one to know when a cure has been effected? If quinine is given over a sufficiently long space of time the plasmodia will be killed. Estimates of from one to six months of quinine administration are given as the length of time necessary to accomplish this. Quinine taking is disagreeable, especially to those who have a special idiosyncrasy for it, and moreover they object to a prolonged administration when they see no effects of disease.

Given a case in which there are chills and fever, followed by sweating, and in which plasmodia can be found in the blood, the diagnosis is simple. But we rarely see a case that has not taken at least some quinine and after 24 to 48 hours of even moderate doses the plasmodia disappear from the circulation. The demonstration of plasmodia is very positive but sometimes it requires considerable laboratory skill and a great deal of work to identify them. Besides, a smear made during a chill or within eight hours after, is likely to appear free from the plasmodia. There are changes in the normal blood components which are suggestive, such as a relative increase of large mononuclear cells which persists for three to six weeks after the acute symptoms subside. Polychromatophilia may be present for weeks, but on the other hand may disappear early. These findings are only relative and require not only a painstaking search but considerable experience for correct interpretation.

Plehn found, and it is generally recognized, that there are inflammatory changes in the liver as well as in the spleen in malaria. Coplin [2] says, "in the acuter cases of malaria the hepatic changes resemble those seen in certain bacterial infections, the organ is swollen . . . and the biliary passages are not infrequently the seat of a well marked catarrhal cholangitis. In more chronic cases the pigmentation is marked, the fibrous tissue increased, and not infrequently a moderate degree of red atrophy is present." It is upon these inflammatory changes that the rationale of the urobilin test is based. Urobilin is formed in the intestine by the reduction of bilirubin through bacterial activity. The urobilin is absorbed and carried back to the liver. A normal liver sends it back to the intestine with the bile where it is excreted. A liver inflamed from whatever cause allows it to escape to the blood stream where a portion of it is excreted through the kidneys. Therefore, as we said before, the presence of urobilin in the urine is not specific for malaria but in our series of diagnoses of the liver cases in which the urobilin was found, was so evident that there was no trouble in differentiation. Also where we meet considerable blood tissue destruction, as in advanced pulmonary tuberculosis or carcinoma, and very occasionally in a normal subject, a faint positive may be present.

The technic of the test is quite simple. Add equal parts (2-3 cc.) of a saturated solution of zinc acetate in absolute alcohol to fresh urine. Shake. Then add two to three drops of a special Lugol's solution, made up as follows:

I.....1
KI.....2
Aqua.....50.

Shake and filter. A fluorescence in the filtrate indicates a positive reaction.

* Read before the California Northern District Medical Society at Sacramento, November 9th, 1915.